

claims 1-29. Thus, despite repeated attempts to convince the Examiner that the cited references clearly fail to teach, or even suggest, the claimed invention, the Examiner has maintained his rejection of claims 1-29, which is certain to be overturned on appeal. Rather than spending further time reiterating the same arguments clearly establishing that the cited references fail to teach, or even suggest, the claimed invention, Applicant has elected to pursue the Pilot Program.

I. THE REJECTION OF CLAIMS 1-29 UNDER 35 U.S.C. § 112

The Examiner asserts that the limitation "uninterrupted by any pre-existing volume-level snapshot of the plurality of units of storage" is not supported by the written description of the original disclosure. The Examiner also asserts that the limitation "wherein the storage management system is further configured to identify historic data that were present in a specified portion of the plurality of units of storage at any point during the continuous period of time based at least in part on the backup data" is not enabled by the specification. Applicants respectfully disagree.

Although the limitation "uninterrupted by any pre-existing volume-level snapshot of the plurality of units of storage" may not be literally described in the specification, this limitation was inherently disclosed in the original disclosure at the time of filing the present application. As stated in MPEP §2163.02, the fundamental factual inquiry is whether a claim defines an invention that is clearly conveyed to those skilled in the art at the time the application was filed. The subject matter of the claim need not be described literally (i.e., using the same terms or in *haec verba*) in order for the disclosure to satisfy the description requirement. Also, as stated in MPEP §2163.07(a), by disclosing in a patent application a device that inherently performs a function or has a property, operates according to a theory, or has an advantage, a patent application necessarily discloses that function, theory or advantage, even though it says nothing explicit concerning it. The patent application may later be amended to recite the function, theory, or advantage without introducing prohibited new matter. In re Reynolds, 443 F.2d 384, 170 USPQ 94 (CCPA 1971), In re Smythe, 480 F. 2d 1376, 178 USPQ 279 (CCPA 1973).

In both the "Background of the Invention" and the "Detailed Description" sections, Applicants inherently disclosed the limitation "storing backup data that correspond to a continuous period of time uninterrupted by any pre-existing volume-level snapshot of the plurality of units of storage," as presently claimed. For example, in paragraph [0008], Applicants criticized snapshot creation as being "inefficient and costly because it increases the storage capacity required to backup the data storage device at multiple points in time." This is because, in the snapshot approach, "each unit of storage is saved regardless of whether the data stored in it is unchanged since the time that the previous backup was made." Further, in paragraph [0009], Applicants criticized the snapshot technology as being ineffective because "snapshots are created at

the then current point in time either in conjunction with the users [sic] request or as a result of a previously scheduled instruction to create a snapshot of the stored data" and therefore do not "allow the user to employ hindsight to recreate a data set that was current at some past time."

In the "Detailed Description" section, Applicants referred to "snapshot" in two instances. In paragraph [0097], a time image in accordance with the claimed invention was compared to a traditional snapshot. A time image is "an image that may not have previously existed at any time since the recovery time." "In contrast, a snapshot is a duplicate that is generated at the then current time." In paragraph [0067], the word "snapshot" appeared in the following sentence (emphasis added): "The storage management device 38 thus can present a continuum of "prior images" of a data store to the host 34 regardless of whether a snapshot was generated prior to the request time where each prior image is a view of the disk at the recovery time." This sentence, together with the lack of reference to snapshot creation in data backup processes, clearly conveys the fact that the claimed invention does not rely on snapshots at all. In fact, pre-scheduled creation of volume-level snapshots would be unnecessary and wasteful in the context of the present invention. Reading the original disclosure, a person of ordinary skill in the art of data storage would appreciate that the claimed invention has completely broken away from the traditional mentality of snapshot creation. Unlike the Wu et al. reference (as discussed below), the claimed invention no longer requires snapshots in data backup or restoration.

Regarding the limitation "wherein the storage management system is further configured to identify historic data that were present in a specified portion of the plurality of units of storage at any point during the continuous period of time based at least in part on the backup data," the Examiner asserts that this limitation would require the invention to teach a measurement mechanism that provides infinite precision to pinpoint the precise time within a time interval. Applicants respectfully disagree.

The phrase "at any point during the continuous period of time" shows a capability of the claimed invention to identify historic data present at a past time, wherein the past time can be specified to be any point within a continuous time interval and need not be a pre-scheduled point in time. In other words, since "the storage management system automatically intercepts all write commands issued to the plurality of units of storage" during a continuous period of time, the storage management system is able to recover the status of a storage unit based on the recorded write commands.

The step of intercepting all write commands requires no time measurement of infinite precision - each write command capable of affecting the storage units can no doubt be intercepted or captured by the storage management system. Such write commands are "meaningful changes"

as understood in the art, and it is also generally understood that any subsequent data restoration is with respect to those "meaningful changes" based on current technological capabilities.

The step of restoring or identifying historic data also does not requires time measurement of infinite precision. The claim language indicates that a user can specify any point within the continuous time interval and the historic data existing at that point can be restored. The restoration refers to the "status" of storage units at a past time, not any infinitesimal changes actually occurring at that point in time. (If a storage unit was still being written at that point, its status has not changed yet.) No matter how precise the user specifies this past time, the copy-on-write records accumulated up to that point can facilitate restoration of historic data to that point in time. For example, the user may very well specify a point in time such as 12:44:57.00000000001. However, if no write command was recorded since 12:44:55, the status of a storage unit at 12:44:57.00000000001 would be the same as 12:44:55. If a next write command occurs at 12:45:08, then at any point between 12:44:55 and 12:45:08, be it 12:44:59.999999999999 or 12:45:01.3333333333333333, the status of the storage unit remains the same as when the last write command was executed at storage unit (i.e., at 12:44:55). The Examiner is also referred to paragraph [0067] where Applicants described the ability of the storage management system 38 to present "a continuum of "prior images" of a data store."

In view of the foregoing, it is respectfully requested that the rejection of claims 1-29 under 35 U.S.C. § 112 be withdrawn.

II. THE REJECTION OF CLAIMS 1-29 UNDER 35 U.S.C. § 102 & 103

As set forth in greater detail in Applicants' responses dated January 23, 2007, and June 18, 2007, the cited references fail to teach, or even suggest, the claimed invention. Specifically, like previously cited references, Wu et al. discloses a data backup approach that is still based on the creation and storage of volume-level snapshots. The entire disclosure of Wu et al. is directed to an optimization process in the management of volume-level snapshots, i.e., "techniques for reconstructing deleted snapshot copies of a data volume" (Field of the Invention section)(emphasis added). The sheer size of volume-level snapshots dictates that only a limited number of such snapshots can be maintained in a storage system. That is why Wu et al. finds it necessary to provide a snapshot reconstruction method to recover, in a limited capacity, a deleted snapshot. In other words, Wu et al. still relies on volume-level snapshots and has not disclosed or even suggested a data protection technique, as presently claimed, that can dispense with volume-level snapshots.

In addition, although Wu et al. discloses the creation of a modification log, which is somewhat similar to a copy-on-write operation, the use of the modification log is limited to the context of snapshot reconstruction. The modification log is only maintained for a period of

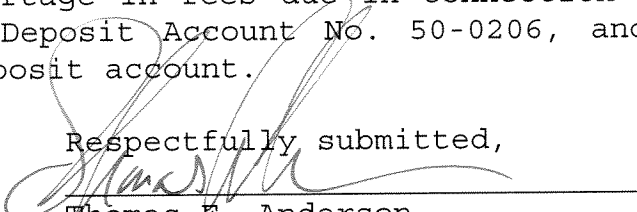
time between two consecutive snapshots, and it is unclear whether the maintenance of modification logs is done continuously for every two consecutive snapshots. In any event, the modification log is created with necessary reference to at least one volume-level snapshot. Furthermore, Wu et al. does not teach or suggest the use of the modification log to recover portions of a data volume at any point in time. Instead, Wu et al.'s use of the modification log is expressly limited to the reconstruction of a previously created but currently deleted volume-level snapshot. That is, the data recovery point in Wu et al. is limited to the time points at which a snapshot was created, and the recovery is on the level of data volumes. In contrast, the present application claims the use of backup data to restore any portion of a data store to any point in time.

In summary, Wu et al. relies on volume-level snapshots and does not disclose or even suggest a data protection technique, as presently claimed, that can dispense with volume-level snapshots. Also, while Wu et al. does disclose a modification log, such a modification log is created with necessary reference to two consecutive volume-level snapshots for the limited purpose of reconstructing a previously created but currently deleted volume-level snapshot. Wu et al. does not teach or suggest the use of backup data to restore any portion of a data store to any point in time. Thus, the teaching of Wu et al. clearly differs from the claimed invention. Also, Gilly et al. fails to disclose or even suggest the deficiencies of Wu et al. regarding the claimed invention, and thus the combination of Wu et al. with Gilly et al. fails to render any of the pending claims obvious.

In view of the foregoing, it is respectfully submitted that the rejections of claims 1-29 are in error. Accordingly, for the foregoing reasons, Applicant requests an appeal conference be convened so as to advise Applicant whether the Office will: 1) allow the present claims; 2) reopen prosecution and issue a new office action; or 3) allow this case to proceed to appeal.

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Respectfully submitted,


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